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## REPORT

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## SOME DEVELOPMENTS IN THE FIELD

## OF SOVIET CHEMISTRY AND CHEMICAL TECHNOLOGY

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Soviet scientists are patriots as far as their country, their science, and their civilization are concerned. This patriotism is combined with internationalism, i.e., respect for the civilization of all nations. One cannot respect other nations unless one loves and respects one's own people. On the other hand, Soviet scientists are waging a relentless fight against bourgeois ideology in general and cosmopolitanism in particular. The latter is a most poisonous and insidious tool which Anglo-American monopolistic capitalism is utilizing in its preparation for a new world war and an attack on the Soviet Union.

The USSR government is very much concerned with the training of scientific and technical personnel. The staffs of instructors at USSR higher educational institutions comprise 70,000 and include more than 5,000 professors. At the higher educational institutions alone, 20,000 aspirants are being prepared. Eighty scientific research institutes have been opened at 32 universities and their number continues to grow. The erection of a huge new building of the Moscow University where young people will find the most favorable conditions for study, work, and rest is typical.

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As a result of a number of governmental decisions, scientific workers in the USSR enjoy exceptionally favorable economic conditions which go far beyond the fondest dreams of scientists in capitalist countries.

By a decision of the Communist Party, the chemical industry became the leading branch of socialist industry. Its leading function became especially apparent during World War II, when the army was adequately supplied with munitions and other products required in connection with the war.

In the field of fertilizers, the 1946-51 Five-Year Plan provided for doubling the output of phosphate fertilizers, an increase in the production of nitrogen fertilizers by a factor of 1.8, and an increase of the production of potassium fertilizers by a factor of 1.3 with reference to the quantities produced in 1940. The USSR fertilizer industry furnishes a good example of correct scientific thinking and industrial pioneering evinced by Soviet scientists and engineers. In spite of the opinion generally held by foreign specialists to the effect that nepheline apatite is an unworkable crude material, a huge industry based on just this type of apatite was created beyond the polar circle in the USSR. Two large well-appointed cities, Kirovsk and Monchegorsk, were built in connection with this development beyond the polar circle. The apatites, which according to the original plan were to be utilized for the manufacture of fertilizer only, are now being used in more than 20 types of production. The chemical treatment of nepheline-apatite ores is an original achievement of the Soviet Union; up to that time, apatites had not been converted industrially anywhere.

There was practically no potassium industry in Russia before the revolution. The German capitalists saw to that. Since the first shaft was driven in 1927 at Solikamsk, the largest industrial center in the world for the production of potassium fertilizers has come into being there. The Solikamsk industrial center utilizes the most extensive potassium salt deposits in the world and represents the latest achievement as far as new and originally designed equipment is concerned. All potassium mines are completely mechanized.

A whole network of scientific research institutes participated in the creation of the potassium industry. This includes the Institute of General and Inorganic Chemistry of the Academy of Sciences USSR, the Ural Chemical [Scientific Research] Institute, and the Leningrad Institute of Applied Chemistry. Academician N. S. Kurnakov and his school have made valuable contributions to the investigation of salt equilibria in connection with naturally occurring potassium salt deposits.

Of great importance in solving problems connected with the apatite and potassium industries was the work done by the NIUIF (Scientific Research Institute of Fertilizers and Insectofungicides), where methods for the production of potassium chloride and highly concentrated potassium fertilizers (under utilization of all by-products) were developed.

The Agrochemical Laboratory of NIUIF, the Timiryazev Academy, and other scientific research institutes have done extensive experimental work on the application of phosphate, potassium, and nitrogenous fertilizers in agriculture. Ammonium nitrate was first used as a fertilizer on a large scale in the USSR. Recently, a method for granulating ammonium nitrate has been developed, so that the fertilizer can be introduced into the soil in this more effective form.

The nitrogen industry began to grow during the First Five-Year Plan and continued to expand and develop after that. Scientific work had a considerable influence on this development. The work done at the Institute of Physical Chemistry imeni L. Ya. Karpov on the synthesis and oxidation of ammonia is on a considerably higher level than similar work done abroad.

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From the viewpoint of the fertilizer industry and the chemical industry in general, progress achieved in the field of sulfuric acid production was of great importance. As a result of efforts made by all concerned, the efficiency of sulfuric acid production in the USSR surpassed the best results attained abroad. This progress is due to work done at the Scientific Research Institute of Fertilizers and Insectofungicides, the Institute imeni Mendeleev, and plant laboratories. The catalytic method of sulfuric acid production was also perfected by workers at the Scientific Research Institute of Fertilizers and Insectofungicides and the Institute of Physical Chemistry imeni Karpov. In the course of this work, theoretical investigations by a number of Soviet scientists on heat transfer in chemical equipment were utilized and a very stable and cheap catalyst replacing platinum was developed. The workers in question also advanced a new and apparently more accurate theory of the kinetics of oxidation of sulfur dioxide to sulfur trioxide. The industry of sulfur production from gases of copper smelting plants developed in close interdependence with Soviet science.

The production of salts from the water of lakes and of the Kara Bugaz Gol bay is being carried out on an extensive scale. The work of Academician Kurnakov and his school was of outstanding importance in connection with the development of this industry.

Technical electrochemistry has advanced considerably in the Soviet Union. This refers to the production of chlorine and alkalis, the electrometallurgy of aluminum and magnesium, and other fields. Many chemical schools and institutes of the chemical and metallurgical industries participated in the development of this particular branch of industry. Among them are: P. P. Fedot'yev's school, GIFKh (State Institute of Applied Chemistry), UNIKhIM (Ural Scientific Research Chemical Institute), and the Institut Narodnogo Khozyaystva (Institute of National Economy).

An industry of chemical sources of electric power was also created. Theoretical and practical work done at the Institute of Physical Chemistry, Academy of Sciences USSR, and the Institute of Physical Chemistry imeni Karpov have contributed much to the development of this industry. With respect to theory, USSR electrochemical work is on a higher level than the corresponding work done abroad. The principal lines of USSR research were concerned with development of the theory of electrochemical processes based on investigation of the properties of the metal surface and under consideration of the phenomenon of solvation.

Chemistry is being applied extensively in both ferrous and nonferrous metallurgy. In this connection, one may refer to the assistance given to the metallurgical industry by Baykov and his school as well as to the contributions made to the production of various alloys by Kurnakov and his institute, IONKh, (Institute of General and Inorganic Chemistry) Academy of Sciences USSR. The application of the method of blowing blast furnaces and open hearth furnaces with pure oxygen, according to a suggestion made by Academician I. P. Bardin, holds great promise for the metallurgical industry.

Soviet scientists have accomplished much in the field of corrosion theories and the fight against corrosion.

New ideas on the effect which surface-active compounds have on the mechanical strength of solids have led to various practical applications in metalworking, the drilling of rocks, and building technology.

The technology of glass, ceramics, refractories, acid-resistant materials, building and other materials, etc., was advanced by chemists active at GOI, (State Optical Institute), VIAM (All-Union Institute of Aviation Materials), and elsewhere. The general expansion of this field has led to the necessity of organizing the Institute of Silicate Chemistry under the Academy of Sciences USSR.

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Many organosilicon compounds which have been synthesized by Soviet chemists are being applied in various branches of production.

A powerful carbide and acetylene industry has been created and this industry serves as a basis for the production of a number of important organic and inorganic substances. A number of inorganic syntheses on the basis of carbide was developed by GIPKh. Organic syntheses using acetylene as the initial crude material have been introduced on an extensive scale. It is indisputable that Soviet research leads the world in this particular field.

Investigations on organometallic and elemento-organic compounds which are of importance from the viewpoint of the synthesis of fine organic compounds have been carried out at a number of institutions in the USSR. This work has been brought to a more advanced stage than similar work done abroad, particularly that done at the Institute of Organic Chemistry, Kazan' Affiliate of the Academy of Sciences USSR.

The Soviet Union organized a powerful synthetic rubber industry earlier than any other country in the world. Many types of synthetic rubber are now being produced in the USSR. The kinetics of polymerization and the theory of the physical state and mechanical properties of polymers have been developed more thoroughly in the USSR than abroad.

A plastics industry has also been created in the USSR and a great variety of plastics is being produced. Plastics are being applied extensively in the Soviet Union's electrical industry. In the field of synthetic fibers, an industry using rayon, acetyl cellulose, and caprolactam has been developed. Academician F. P. Shorygin and his school have been influential in the creation of a synthetic fiber technology. During the Soviet regime, several large specialized branch scientific research institutes and laboratories dealing with the study of plastics and their production have been founded. In recent years, a new scientific center, the Institute of High-Molecular Compounds, was organized under the Academy of Sciences USSR.

During the period of the Stalin five-year plans, the synthetic dyestuff industry became several times larger. In the course of the past 20 years, we created our own synthetic dyestuff industry.

An alkaloid industry extracting anabasine, salsoline, nicotine, and other alkaloids used for combating insect pests and in medicine was organized. Academician A. P. Orekhov and his school did extensive work on USSR plants bearing alkaloids and on the isolation of these alkaloids from plant material, thereby assuring Soviet science a leading position in this field.

A wood chemical [wood distillation and naval stores?] industry was developed under participation of chemists from the Leningrad Wood-Chemical Academy (particularly Academician B. Ye. Tishchenko) and the Moscow Wood-Chemical Institute.

The applications of chemistry in the petroleum industry are especially diverse -- the production and refining of gasolines as well as the conversion of cracking gases and natural gases into valuable chemical products. Of particular importance in this field is the work of Academician N. D. Zelinskiy's school, and that of the Institute of High Pressures, Academy of Sciences USSR, and Khimgaz (All-Union Scientific Research Institute for the Chemical Conversion of Gases). One may safely say that the scientific theory underlying hydrocarbon conversions has been developed in the USSR more completely and thoroughly than abroad.

The modern theory of gas-oxidation processes, the theory of combustion and explosion of gases (work done at the Institute of Chemical Physics, Academy of Sciences USSR), and the theory of gasification and combustion of solid fuel (work done at the Power Engineering Institute, Academy of Sciences USSR, and the Petroleum Institute, Academy of Sciences USSR) have been developed primarily in the USSR.

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Soviet scientists have created the theory of chain reactions.

Intensive work on the underground gasification of coal is being done in the USSR.

Successes achieved by the Soviet photographic and motion-picture industry are largely due to work done by USSR chemists. The theory of emulsion cooking, of the latent image, and of the development process have advanced further in the USSR than abroad.

The theory of absorption and adsorption of gases by adsorbents, which is very important in connection with a number of practical problems, has been developed by Shilov. Work in this field is being continued by members of his school.

USSR science has achieved significant results in investigations on the nitration of organic compounds and synthesis with the aid of an electric discharge.

At present, the USSR industry uses exclusively domestic catalysts. This is a result of persistent and concentrated work by plant engineers and scientific collaborators of research institutes. In this connection, the investigations on the mechanism of catalysis carried out in the USSR by organic chemists belonging to Zelinskiy's school and physical chemists are much more extensive and interesting than work in this general field which is being done abroad.

Soviet chemistry has become a powerful force that assures the availability of any type of product which may be required by the country and is capable of fulfilling any task which may be set to it by the Communist Party and the government.

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